

ESTABLISHMENT OF *UROPHORA QUADRIFASCIATA* (DIPTERA: TEPHRITIDAE), AN INTRODUCED SEEDHEAD GALL FLY OF KNAPWEED, IN EASTERN CANADA¹

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ABSTRACT: The introduced Palearctic seedhead gall fly *Urophora quadrifasciata* is recorded from several localities in Ontario and Quebec. The eastern Canadian records apparently represent the northern expansion of populations from the central and eastern United States. The absence of the usual eastern North American host plant, *Centaurea maculosa*, at some of the Quebec collecting sites suggests that this tephritid can use other species of *Centaurea* as hosts in those areas.

Urophora quadrifasciata (Meigen) is a Palearctic tephritid fly that was introduced to western North America in 1972 as a biological control agent of diffuse knapweed (*Centaurea diffusa* Lam.) (Asteraceae) in rangeland (Julien 1982). The larvae of *U. quadrifasciata* also feed on spotted knapweed (*C. maculosa* Lam.) in western and eastern North America (Wheeler and Stoops 1996, Lang et al. 2000). Because of the major economic impact of *C. diffusa* in the west, post-release establishment and range expansion of *U. quadrifasciata* have been more closely monitored than in eastern North America, where *Centaurea* spp. are considered less invasive weeds.

Releases of *U. quadrifasciata* in western North America were successful and the species is well established as far east as Alberta, Wyoming, and Colorado (Lang et al. 1997, 2000). Releases were also made in Quebec in 1979 (Julien 1982) and Maryland and New York in 1983 (Hoebeke 1993, Wheeler 1995). Since the early 1990s *U. quadrifasciata* has become established in the eastern and central United States, with published records from 13 states (Connecticut, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia) (Hoebeke 1993, Wheeler 1995, Wheeler and Stoops 1996). In Quebec, *U. quadrifasciata* was recovered and reared from *C. maculosa* at the release site in 1982 (A.K. Watson, pers. comm.), but there has since been little monitoring of its establishment and distribution in eastern Canada. Since 1997, we have identified increasing numbers of specimens of *U. quadrifasciata* from many localities in Ontario and Quebec. The purpose of this paper is to document the establishment, range expansion, and apparent host-transfer of this species in eastern Canada.

MATERIAL AND METHODS

Specimens are deposited in the University of Guelph Insect Collection, Guelph, Ontario (DEBU) (Marshall 2001) and the Lyman Entomological

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Museum, McGill University, Ste-Anne-de-Bellevue, Quebec (LEM). Flies were identified using White and Korneyev (1989). In the list of material examined, collectors are abbreviated as follows: HVS - H. Varady-Szabo; SAM - S.A. Marshall.

RESULTS

More than 175 specimens of *U. quadrifasciata* have been collected in Ontario and Quebec since 1997. Most of these were collected in 2000 and 2001; only seven specimens were collected in both provinces in 1997-1999. No specimens of *U. quadrifasciata* were collected in the course of Diptera surveys in appropriate habitats in southwestern Quebec between 1995-1997.

Material examined: CANADA: Ontario: Nottawasaga Bay, 1.2km W Camperdown (44°32'N, 80°24'W), sweep beach and shoreline marsh, 01.vii.2001, S.E. Brooks and C. Chenard (49♂, 57♀, LEM); Bruce Peninsula Nat. Park, Dorcas Bay, Singing Sands (45°11'N, 81°35'W) sweep beach vegetation 02.vii.2001, S.E. Brooks (1♂, LEM); 3km N Miller Lake (45°07.6'N, 81°26.2'W), sweep shrubland alvar, 18.vii.2000, V. Crecco and T. Wheeler (1♂, 1♀, LEM); Bruce Co., Dunks Bay (45°14'59"N, 81°38'27"W), 4-6.vii.2000, SAM (1 specimen, DEBU); Dunks Bay (45°14'59"N, 81°38'27"W), 20.viii.2000, SAM (1 specimen, DEBU); Dunks Bay (45°14'59"N, 81°38'27"W), shoreline, 20.vii-1.ix.1999, SAM (1 specimen, DEBU); Cabot Head (45°15'00"N, 81°17'00"W), 27.viii.1998, SAM (1 specimen, DEBU); Tobermory (45°15'00"N, 81°40'00"W), long grass, 21.vi.1998, D. Vaccari (1 specimen, DEBU); Tobermory, Sunset Point, SAM (3 specimens, DEBU); Dorcas Bay Dunes, dune, 4-19.viii.1997, SAM (1 specimen, DEBU); **Quebec:** Ste-Anne-de-Bellevue, Stoneycroft (45°25.8'N, 73°56.4'W), sweep S end of pond, 28.v.1998, J. Savage (2♂, LEM); Ste-Anne-de-Bellevue, Stoneycroft Pond (45°25.8'N, 73°56.4'W), sweep grass, 20.vi.2000, HVS (1♀, LEM); Lac St François Nat. Wildlife Area, Ruisseau Therrien (45°00'39"N, 74°30.99'W), sweep *Carex* meadow, 19.vi.1999, F. Beaulieu (1♀, LEM); Forillon Nat. Park, Cap des Rosiers (48°50'N, 64°12'W), sweep grasses, 06.viii.2000, HVS (10♂, 2♀, LEM); Forillon Nat. Park, Grande-Grave (48°46'N, 64°12'W), sweep forest path, 16.viii.2001, HVS (1♂, 2♀, LEM); Forillon Nat. Park, Anse Saint-Georges (48°46'N, 64°12'W), sweep roadside, 16.viii.2001, HVS (4♂, 3♀, LEM); Forillon Nat. Park, Sentier Le Castor, sweep forest edge, 16.viii.2001, HVS (23♂, 12♀, LEM).

DISCUSSION

The Ontario specimens represent the first published record of *U. quadrifasciata* from the province, and Forillon National Park on the Gaspé Peninsula is a major northeastern range extension of this species. The Quebec releases of *U. quadrifasciata* in 1979 were at Athelstan (45°02'09"N, 74°10'39"W) in southwestern Quebec (A.K. Watson, pers. comm.). We are not aware of additional releases in eastern Quebec or Ontario, so it is likely that the presence of *U. quadrifasciata* there is due to dispersal of established populations by active flight or by human-mediated dispersal of infested seed heads of *Centaurea spp.* If the distribution of *U. quadrifasciata* in eastern Canada was the result of expansion of the Athelstan population, specimens should have been collected between 1982 and 1998 in southwestern Quebec; this was not the case, so it appears that the eastern Quebec and Ontario populations have been recently derived from populations in the eastern and central United States that have been expanding their range northward during the 1990s (Hoebeke 1993, Wheeler 1995, Wheeler and Stoops 1996).

Urophora quadrifasciata was the most abundant species of acalyptrate Diptera observed at the Camperdown site; the 106 specimens collected represented a small fraction of those observed. Similarly, *U. quadrifasciata* was one of the dominant acalyptrate species observed at the Sentier Le Castor site in Forillon National Park. Although no efforts were made to rear specimens from *Centaurea* at those sites, the abundance of adult flies in late summer suggests that larvae may have an impact on populations of *Centaurea* at the sites.

There are no records of *Centaurea maculosa* in Forillon National Park; the most abundant knapweed species in the park is *C. nigra* L., with some records of *C. montana* L. (S. Brodeur, pers. comm.). Thus, in eastern Quebec it appears that *U. quadrifasciata* is using a host species other than *C. maculosa*. *Urophora quadrifasciata* has been reared from *C. nigra* in Europe (White and Korneyev 1989) but not in North America; there are also records of *U. quadrifasciata* from *C. dubia* Suter and *C. jacea* L. in the eastern United States (Hoebeke 1993, Ruhren 2000), suggesting that it can exploit multiple species of non-target host plants. Further monitoring and rearing from potential host plants are needed to establish the distribution of *U. quadrifasciata* in eastern Canada, the species of host plants attacked, and the impact on local populations of *Centaurea* species.

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